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*THE DUTY AND RESPONSIBILITY OF THE UNIVERSITY IN MEDICAL EDUCATION.**

AN experienced railway engineer once told me that when about to establish a grade for a line or railway across a mountain chain he no longer started at the base of the mountain and endeavored to seek a practical ravine or water course through which the line might be led upward to the top of the divide and thence down to the plain below on the farther side of the mountain. He had found from experience that to pursue this course involved him in bad grades and increased difficulties of construction. This method of survey, which lacked a comprehensiveness of plan and breadth of detail so essential to secure the best route, has been abandoned after long trial and by many engineers. His present method was to examine the mountain range first to discover the most feasible passage at the higher level, and when he had once found it he was able to determine with comparative ease the grades required to connect it with the base of the mountain, and could then construct the most practicable and least expensive route.

It is my purpose to-day to urge that medical education be similarly approached from the vantage point of the university with its lofty standards, rather than from a lower point of view, with the hope that

* Annual address to the graduating class in the Yale Medical School, June 23, 1903.

we may be able to perceive more clearly its vital relationship to higher education and its absolute dependence as a growing, progressive science upon the stimulation afforded by university methods, aims and ideals.

To discuss an educational question before university men suggests the appropriateness of the quotation from Confucius with which an eminent scientist once prefaced an address made under similar circumstances: 'Avoid the appearance of evil: do not stoop to tie your shoe in your neighbor's melon patch.' A member of the teaching staff of one of the newest schools of medicine ought to display a degree of modesty in the presence of medical teachers whose thoughts and activities have been molded by the traditions of one of the oldest medical schools in the United States, the sixth in point of time of establishment, and should hesitate above all to urge the duty and responsibility of a university in medical education. I am sure, however, that you will pardon the liberty which I take, for the reason that the relations of medical education to other forms of education and to other parts of the educational system are still unsettled, and it is the privilege, and no less the duty, of all medical teachers to contribute something towards the development of medical teaching from a special and inferior position, until it attains what I believe is to be its final adjustment as one of the highest branches in the general system of university training. Perhaps I may also plead in mitigation of my indiscretion a degree of hereditary relationship to Yale in the fact that my father graduated here in medicine in 1830; my grandfather was a student about 1795, but did not graduate; my great-grandfather graduated in 1778; and my great-great-grandfather in 1739, and may speak as one whose speech can be tolerated because of kin, albeit remote.

In the original development of medicine there was little necessity or opportunity for its scientific study, because the physician was nothing else than a priest. By the access to the gods which his office afforded, and his presumed knowledge of their modes of thought and springs of action, he learned how to influence them, and hence became skilled in the treatment of disease. It was apparently altogether an era of preventive medicine. Disease was universally regarded an evidence of the wrath of an offended deity, and the only way to prevent its ravages was to appease the divine displeasure. If the deity was prevailed upon by prayer or persuaded by sacrifice to hold his destroying hand, disease disappeared. The theory of disease was simple and the methods of cure were obvious. A knowledge of the laws of health and disease was not required. It was only requisite to keep on good terms with the divinity and not to anger him by neglect or sacrilege or presumption. This was the medicine of Moses, of Job, of Homer and of semi-civilized people still the world over.

Later, when the conception of the power and malign influence of the inferior gods of the underworld developed, the physician who had formerly been a priest solely, became in addition a magician and wonder worker to the end that he might overcome the machinations of evil deities by invoking the aid of good deities or compelling the assistance of more powerful and possibly more unscrupulous deities than those who had originally produced the disease from motives of pure malevolence and hatred to mankind. He studied not the law of disease, its mode of manifestation and the remedies which would cure it, but rather sought to ascertain who was responsible for it and what magical rites

and formulæ would counterwork his power. In some instances, in fact, the physician attempted by magic to compel the powers of darkness to act in opposition to each other, and thus, by dividing their power for evil, to rescue the victim of their cruel wrath. Unless the physician's magic influence, or his *orenda,* to use the Indian word given by Powell to express the influence which he thus acquired over deities with mischievous tendencies, was competent to accomplish this result, he was regarded an unsuccessful practitioner and had little fame and less pecuniary reward.

While among many barbarous nations the priest and physician became one and the same, and the physician soon degenerated into a magician and wonder-worker, the conception of disease as a visitation of God has never disappeared, and even now dominates belief and influences conduct. Disease is considered a judgment upon a sinful individual or an erring nation, to be removed by fasting, humiliation and prayer, rather than by remedies and sanitary measures. I have witnessed a day of fasting to arrest the scourge of cholera, and a few days ago I read in a newspaper of the blessing of throats with prayer and candles upon a saint day to prevent the development of diphtheria. Allied to this is also the Christian Science conception of bodily disease as sin, due to a lack of faith in the power and immanence of God. If such conceptions are true, why should we study medicine at all? As students of rational medicine we believe otherwise. At any rate, we do not go to so-called religious teachers to learn the scientific laws of health and disease.

The early conditions of pioneer life in America were not such as to foster the study of medicine. It is true that many well-equipped medical men, educated in England or on the continent, emigrated originally with the colonists and practised the healing art among the early settlers. These men, however, raised up in their turn an inferior class of practitioners through a system of apprenticeship. Apprentices were found in all parts of the country who saw the sick in connection with their preceptors, and thus acquired a degree of familiarity with the aspects of ordinary disease. Opportunities for the study of medicine in the modern sense did not exist. There were no schools of anatomy or facilities for dissection of the human body. A few practitioners after the expiration of their apprenticeship went abroad to Aberdeen, Edinburgh or Leyden, but the majority were prevented by poverty and lack of leisure from availing themselves of these opportunities for medical study. Dr. Welch in a recent address here has called attention to the clerical physicians who flourished in New England, 'those ministers of the soul and comforters of the sick' who did much to keep the spirit of scientific medicine alive but who probably did comparatively little to promote the better study of medicine. They were amateurs rather than physicians. They enjoyed medicine and dabbled in it, but did not live by it. An occasional woman also at this early day bore an honorable part in practical medicine. Ouchterloney, of Louisville, for example, speaks of Mrs. Frances Coomes, of Kentucky, in the middle of the eighteenth century, who was probably the first female physician upon this continent. She was self-taught, but had remarkable vigor of intellect, originality, fertility of resource and strength of character, whose fame as a surgeon, physician and obstetrician extended far beyond the limits of her state. Her operating table was a huge black walnut log, whose upper surface had been rudely smoothed, her instruments were fashioned by herself from domestic cutlery, her ligatures were

obtained from the hides or sinews of deer, and her remedies were the products of the field or the forest about her.

The first attempts at medical instruction in America were made in private schools which supplemented the systems of apprenticeship just mentioned. Cadwallader of Philadelphia, Hunter of Newport, and Shippen of Philadelphia, all in turn gave private demonstrations in anatomy, as this department of study for obvious reasons was inadequately taught under the apprentice and preceptor system. The step from private to public medical schools in connection with existing colleges was soon made. The first, now the University of Pennsylvania, was established as a department of Philadelphia College in 1765; King's College, now the Medical Department of Columbia University, in 1767; Harvard Medical School in 1783; Dartmouth Medical School in 1798; the University of Maryland in 1807; and Yale Medical School in 1813. It is gratifying to note that all these schools were established in connection with well-known and well-established institutions of learning, and were not independent and isolated schools of medicine alone. The movement which brought about the establishment of the Yale Medical School, it should be remarked, came from Yale College, through President Dwight. They were an outgrowth, however, of pioneer conditions and their primary purpose was to furnish medical teaching to supplement the apprentice and preceptor system. They gave courses of lectures on the science of medicine; practical or, rather, clinical work followed under the preceptor. The system was a necessity in a new and undeveloped country, sparsely populated and poorly supplied with medical men. It was a product of American soil, and not an imitation of conditions abroad. These schools were established by well-trained, scholarly men, and the medical instruction given was fully equal to that given in law or theology, where a similar system of preceptors existed. Entrance examinations were required and the same standard of education and fitness exacted as for admission to college. Unhappily this standard of educational requirements so essential to a learned profession was not long maintained. After 1820, and for a half-century and more, medical education steadily retrograded and standards for entrance to medical schools and for graduation were progressively lowered. Schools of medicine upon a commercial rather than an educational foundation sprang up far from centers of population or facilities for clinical teaching, and degrees were conferred upon persons who were manifestly unfit to enter the profession. The majority of these schools were not attached to any institution of learning, or, if nominally attached, they were destitute of any vital connection; they were parasitic growths, like the mistletoe upon the oak, having neither the leaf nor the fruit of its presumptive parent stem. They were founded in every part of the country, and the study of medicine was promoted by one or more short courses of lectures, generally of three or four months' duration, without practical work, too often given to young men of very limited education. The same courses were repeated year after year to the same students, and no difference was recognized between the instruction given to the man about to graduate and the one who had just entered upon the study of medicine. Medical knowledge flowed like the blood-stream in the human body, and every student was supposed to be able to select and to appropriate what was most needed for his growth and mental development. As a witty friend expressed it recently, medical knowledge was pumped

into these students by didactic lectures, to be pumped out again by the final examination. The quantity which was thus 'recovered,' to use a chemical phrase, was sometimes painfully small and generally of little practical value.

In a generally gloomy outlook for adequate medical training a few brighter spots developed. It is gratifying to know that during this whole period Yale Medical School made a strenuous effort to maintain a higher standard. She early exacted a matriculation examination and increased the term of medical study; she inaugurated daily recitations in 1855 to supplement didactic lectures, and established laboratory courses in 1867.

In 1864 Chicago Medical College, now the Medical Department of Northwestern University, graded its course of lectures and made the minimum course three years.

In 1870 Harvard Medical School initiated a similar movement and taught medicine progressively rather than cumulatively. The University of Michigan also extended its course of instruction to three years of nine months each, and made some minor educational requirements for admission. For the most part, however, the preliminary education required was ludicrously inadequate, when one considers that the medical school essayed to fit the individual to enter a learned profession. In some catalogues it was specified that the student should have a knowledge of grammar, orthography, arithmetic and an ability to write a composition of six hundred words. In others it was stipulated that the student should have a high school education and a certificate of good moral character. Whenever any attempt was made to raise the educational standard, pathetic appeals were made successfully in behalf of communities where it was alleged that well-educated physicians could not be maintained or appreciated.

It is doubtful whether this unfortunate state of affairs would have been remedied for many years to come had the initiative been left solely to those who were charged with the responsibility of giving instruction in these so-called medical schools. Fortunately, however, public-spirited medical men were found in almost every state in the Union who insisted that men should not be permitted to practise until they had shown their competency and education by passing an examination before an impartial examining board. This was the beginning of a reform in medical education which dates from about 1890, and which has already changed the aspect of medical schools. The object of medical teaching up to this time had apparently been to fill up the profession by making it easy for every one to enter. The object now seems rather to secure well-trained men with an adequate education.

With the advent of the new era came a minimum standard of educational qualification for entering medical schools, a minimum period of study and a minimum grade of acquirement in order that the graduate of the school might be considered eligible for an examination for a license to practise, all of which were far in advance of what had existed. This has enforced a better preliminary education, a graded course of study, and a higher standard of attainment upon graduation.

It has been said in the past, is now being said, and will be said in the future, as an excuse for poorly equipped physicians, that well-educated physicians are not required in rural districts or where the population is sparse and the people are poor. An early experience in semi-pioneer life convinces me that this is an error. The well-educated physician does not avoid the country, nor does he leave the country for the city after he is once established. The list of eminent medical men who have lived

in the country and still continue to reside there is a long one. Not long ago I had an interview with a physician who resides in a little village in the mountains of North Carolina, and who had gone forty miles to a mountaineer's cabin a few nights before to trephine an incised wound of the skull successfully by the light of a coal-oil lamp, and to remove a knife blade which had been broken off in the wound and which was giving rise to serious and rapidly fatal brain symptoms if relief had not been afforded. He made the diagnosis and performed the operation which snatched the patient from certain death, from his knowledge of cerebral localization. Similar instances of modern knowledge of medicine among country practitioners are frequent. As a matter of fact, the half-educated physician is much more apt to settle in the crowded city than in the country, and the descent into quackery and charlatanism is more easily made there. A good education, I do not say a college degree of necessity, preliminary to the study of medicine is after all the surest safeguard against a misapplication of the knowledge which the physician has acquired.

In the study of medicine we find a combination of technical and theoretical knowledge rarely required by any other profession. The amount of actual knowledge which the student must acquire by an act of memory is truly appalling. I heard not long since of an elderly physician who apologized for his failure to keep pace with the progress of pathology and bacteriology, by reason of his age, but added with pride that he once knew the names of all the bones of the human body. I think every physician may reasonably feel a similar and lasting pride in his feats of memory as a student. The student must know the names, relations and functions of the bones, the arteries, the nerves, the viscera, the nerves of special senses, the brain and spinal cord, and in fact everything about every organ of the human body. He must also know materia medica, pharmacology, chemistry, physiological chemistry, physiology, pathology, bacteriology, hygiene, clinical microscopy and the laws of health and disease. In addition to these branches he must know disease itself in its various manifestations, and learn how to recognize it and how to treat it. In medical study he must cultivate his memory, his powers of observation and his ability to reason from obscure phenomena. He must cultivate his hand to do and his eye to see. While there is still, especially in seeking the causes of disease, much blind groping, medical diagnosis as a whole is no longer an iridescent dream but a growing certainty. Take, as examples of this, malarial fever, tuberculosis, typhoid fever and diphtheria. No one now needs to be long uncertain as to the presence of these diseases, or, if he is, his uncertainty is due to his own lack of training and medical knowledge. And yet I would not be understood as asserting that all the problems of health and disease are equally free from uncertainty. There are difficulties inherent in the factors of the problem which often lead to doubt and uncertainty in the mind of the best trained physician. We can not shut our eyes to the fact that disease is not an entity, an organized enemy of health which attacks the body in a uniform manner, and is to be cast out as a burglar or a midnight intruder is thrust out of your bed-chamber. It is rather the personal reaction of the body of each individual in its own way and in accordance with its own constitution against the morbific agency. The portal by which the same disease enters different individuals may vary widely, the extent of the reaction may vary as widely, and the virulence of the original poison may also vary to an

equal degree. Hence the problems of disease and cure may become most intricate, and over and over again many of the phenomena are in danger of being confused and wrongly interpreted. It has, for example, taken a long time to recognize the fact that the rise of temperature in pneumonia, typhoid fever or tuberculosis is not the disease itself, but merely a symptom of the disease process. Even now we find many physicians whose theory of treatment in these disorders is to combat the rise of temperature by antipyretics, and who honestly think that the patient is cured by subduing what is merely one of the symptoms of the disease. The same was once true of those who thought maniacal excitement was cured by mechanical restraint and by powerful remedies which paralyzed and deprived the patient of his ability to throw himself about. We now know that he was not cured by thus removing the evidence of his disease—in other words, by keeping him quiet—but, on the contrary, his prospects of cure were infinitely lessened by the restraint which the strait-jacket and drug thus imposed upon him.

The demonstration of the presence of a specific organism as the causative factor in the development of many diseases has consequently been a great boon to medicine and has become essential to a proper recognition of the disease and its best mode of treatment. The time may come when the cause of every disease will be equally well known, and to ascertain it is one of the great aims of medical research. Unfortunately, the end is not yet, and in the case of some diseases we must content ourselves with our present half-knowledge.

We now come to the important question: 'How shall medicine be studied?' Here we find ourselves confronted by two theories as to the preliminary training requisite for entering upon such study. On one side we find a strong tendency to shape all preliminary training to prepare the student for medical study. If the preliminary training is to be in a college, we find already in a number of institutions such an arrangement of the course as practically to commence the study of medicine in the third year of the college course and to complete the medical education within two years after graduation from college. In the University of Michigan, Cornell University, the University of Chicago and other similar institutions of high standing this plan has been outlined and will be eventually adopted. Although the bachelor's degree will be considered a preliminary to entering the medical school, the studies of the college will be so combined with those of the medical school as to permit the student to complete his medical course within six years after he has entered college.

On the other side, there is a tendency to divorce the medical education from the college course and to pursue the latter for general culture, irrespective of its bearing upon medical study later. Much may be said in favor of both theories of education. The last-mentioned theory unquestionably presents the broadest view and, if the student has ample leisure, offers the best promise of a true education. It can not be denied, however, that the former view is likely to be more generally adopted and promises to dominate medical education for a time at least. If the student always knew when he entered college that he was to pursue the study of medicine, he might possibly, in these days of elective studies, be able to choose wisely the branches which would best fit him for his subsequent work. In many instances, and perhaps in the majority, the decision to enter the profession grows up slowly and may not be fully attained until he has finished his course of preliminary study. It is altogether probable that he has secured a broader mental

training than if he had contemplated medicine from the commencement of his education and may be equally well fitted to pursue the study, but he finds himself at least one year, and possibly two years, behind his fellow student who had medicine in view from the beginning. For this reason it is probable that the majority of colleges will give elective courses, beginning with the junior year, which will lead immediately to medicine, and that many students will be forced by circumstances to make this early decision.

This hasty and somewhat patience-trying review, I fear, of the circumstances of medical education hitherto in America prepares me now to speak of the duty and responsibility of a university in medical education.

It is apparent that the present requirements for medical education have become so expensive and exacting that schools which have hitherto been maintained as commercial ventures and for the private gain of their owners can no longer be profitable if they honestly seek to do their duty towards the student. Expensive laboratory courses are required in histology, embryology, anatomy, physiology, bacteriology, pathology, clinical microscopy, pharmacology and physiological chemistry. They necessitate much apparatus, many salaried instructors who are precluded by their duties from adding to their income by private practice, and a limitation in the size of the class to permit of personal work. Former methods of medical instruction dealt with students *en masse;* present methods must consider individuals, and the unit of instruction becomes one person instead of five score. If this altered educational condition is to be honestly met by a school which depends upon its fees for its support—and to the credit of many schools, it should be said that they are making the most praiseworthy efforts to meet the requirement—it means a loss of income and an ultimate extinction of the school. With many of them, in fact, the end is not far off. They already suffer from Falstaff's incurable disease—'consumption of the purse.' On the other hand, if the situation is not fully realized and frankly met, we must be prepared to see the commercial school retaining its profits by furnishing insufficient medical instruction and an inadequate training. The medical man is thus fitted, as in the past, to become a practitioner rather than a student and a teacher. To modify a phrase used by another, 'such schools can do something for learners and but little for learning'; in other words, they can help make the doctor, but not the science of medicine.

The present situation, then, demands that schools connected with universities shall perceive the need of the student and protect him from imposition by affording him instruction of a high standard. The university, in fact, must set the standard. The working of the law of supply and demand, it is universally agreed, is no longer adequate to supply the higher education. It must be endowed by individuals or furnished by the state. Individual enterprise and initiative can no longer be depended upon to teach astronomy, the classics, higher mathematics or any other than technical or purely bread-and-butter branches. Medical instruction consequently can not be left to the initiative of the private school any more than can instruction in any other form of higher knowledge. If instruction in medicine is to form part of the university curriculum, the work should be done thoroughly and in such a manner as to add to the dignity of the science. I am aware that, mainly because of the imperfect preliminary education required for admission to the study of medicine, there has always been a query

in the minds of university authorities as to the status of medical science and its claims to be considered a liberal study. The medical student at a university was formerly far from being a matter of pride to his alma mater. His relation to the royal family of letters was apparently a morganatic one. He did not appear on public occasions, was very little in evidence on commencement day, and generally passed without much flourish of trumpets from academic halls to the seclusion of private life. Whatever medical science may have once been in comparison with other sciences, I have no hesitation in saying that now it is the peer of any. Although only the child of the past half century, it can boast of a brilliant series of discoveries. Compare the knowledge which has been acquired of the causation of malaria, yellow fever, tuberculosis, the assured benefits of the diphtheria antitoxin, Haffkine's plague vaccination, Pasteur's anti-rabic inoculation, and the like, with the achievements in any other branch of science. Think of the mental training required to settle the problems of immunity, to investigate questions of bodily metabolism, to know the true action of remedies, and to discover the law of diseases and their mode of cure. Physiology, pathology, hygiene, practical medicine, psychiatry, these are all living branches of medicine which require the highest training which can be given to the human mind to fit it to solve the problems which they present. The medical man needs to know chemistry, biology and physics; he must be trained to use his mind, and to reason from obscure, often imperfectly known, factors. He must be a diligent student of the laws of mind, and keen to observe mental phenomena. Above all, he must have a training of the head and of the heart to fit him for the true exercise of his profession and to deal with problems of the highest importance to the welfare of mankind. Are not such studies worthy the attention of a university, and should not she feel the duty and responsibility of providing adequate teaching for them?

Probably no better illustration could be given of the influence of university ideals upon medical education than is afforded by what has been done in one of the departments of Yale University to promote and develop the study of physiological chemistry. I have no hesitation in saying that the impetus which has been given here to this most important department of chemical study and research has been felt by every medical school worthy the name in America. To Professor Chittenden and the Sheffield Scientific School is due the honor of initiating a most important and heretofore neglected branch of study—one which would probably never have been developed by a school unattached to a university.

The university occupies a vantage ground enjoyed by no mere medical school. She is unselfish, and by reason of her endowment is able to view all educational questions in an unbiased manner, regardless of their effect upon mere numbers of students. She stands for knowledge and truth. She can afford to disregard the mere question of filling up the profession, and need only consider the proper education of competent men. The country suffers from too many medical schools and too many imperfectly educated men. The university is alone competent to limit the production and to improve the quality. The intensely practical studies of the physician, upon the one hand, need the broadening influence of a university atmosphere to bring every branch of science into its proper relations, and to give a proper perspective. The university, upon the other, needs and should foster departments like those of medicine to avoid a

dilettanteism which regards culture as an end and not an adjunct of life. I have sometimes thought that, with the increase of luxury and wealth, and especially with the increase of a leisure class, there has been an increase of those persons who pursue a college course without special purpose or aim. Many of these, in fact, pass through their course without attempting severe study, and are content with the passing joys of an undergraduate existence. Like oarsmen in a boat, they constantly fix their eyes on a receding shore, are satisfied with what they see and do not look in front of them. To such the mental stimulation which comes from university contact with eager, earnest men engaged in branches of medical study which call into keenest activity every faculty, must prove of untold benefit.

Too many medical men reason from case to case as did John Hunter, and frequently these cases are imperfectly observed and inadequately interpreted. The physician needs rather a study of principles deduced from a systematic and painstaking observation of the phenomena of disease and illuminated by scientific conceptions. Already anatomy, physiology, chemistry, bacteriology and pathology are firmly founded upon the scientific method. The practise of medicine and of surgery, pharmacology, food dynamics and bodily metabolism must be similarly based upon scientific deductions. The range of observation required must be wide and the mass of accumulated facts to be gathered for ultimate study must be enormously large. The task of interpreting such observed phenomena calls for the widest training of the human faculty, and where else can this training be secured except in connection with studies of the broadest and most liberalizing character? From every point of view the intellectual aspect of medicine is the most important. To men who have been trained by university studies for research we must look for the future development of medicine. The training of the medical man has been narrow in the past; in future he must draw his inspiration from centers of learning and receive stimulation from his intellectual peers.

A lack of thoroughness is thought by those who are familiar with the educational and industrial development of the world to be a characteristic of the American people. We grasp after results, but are not willing to lay a broad foundation of preliminary education. We have business universities (once commercial colleges), summer universities, correspondence universities and the like, and seek to get knowledge and to secure degrees in the shortest time and with the least possible study. In no profession has this lack of thoroughness wrought so much evil as in the study of medicine.

To you who are to receive the degree of doctor of medicine I offer a hearty word of congratulation, because in the study of medicine it is possible to combine research and practical work, that is, the acquisition of pure knowledge with the application of scientific knowledge to the better care and treatment of sick people. Nothing in my judgment is so stimulating to the student as the possibility of applying scientific knowledge to daily use. I can not speak so positively of other sciences, but I can assert that in the history of medicine it has been found that he who makes the most fruitful discovery is the one who has approached the problem which he attempted to solve through the avenue of practical work. Men who sit down in the privacy of their chambers to make discoveries lack the incentive to produce practical results which comes from actual contact with the outside world and with the hard-and-fast conditions of nature.

Hence whenever I hear complaints on the part of busy practitioners or teachers of medicine that time is absorbed by routine work which in their judgment might be much more profitably spent in research work, I do not always lend a consenting ear to the complaint. I have known many laboratories where teaching was not required which failed to do the work for which they were established. I have known many other laboratories, seemingly overwhelmed by routine work, in which the daily discharge of practical duties led to profound and life-giving discoveries. I would say in passing that it seems to me that under the endowment of research work made by Andrew Carnegie at Washington, the decision not to build a laboratory for special research but to seek out research workers among practical students in the various technical and professional laboratories of the country is eminently wise and philosophical and well calculated to bring larger returns than would be possible in a single laboratory divorced from the every-day practical pursuits of a technical school or university.

For this reason, at least, students who are developed by the smaller colleges are frequently to be congratulated. They become self-reliant, they learn to meet difficulties, they study for love of knowledge and their enforced contact with nature stimulates the scientific sense and makes them productive workers. I have little sympathy too with the study of problems which have no practical value and are mere intellectual gymnastics.

It is not those who have had the most abundant leisure or the best facilities for study who have accomplished the most. Take the historian Parkman with his feeble health, his impaired eyesight and his general state of nervous exhaustion which often permitted no more than five minutes of effective labor each day, and consider how much he accomplished by perseverance and by concentration of purpose and effort. Take Pasteur, not even a physician, yet wrestling mightily and effectively with the problems of disease, handicapped by poverty, paralysis and inadequate laboratory facilities and consider what the world owes to him. Nor do such men belong wholly to the past. All students may draw inspiration and learn humility from a teacher of chemistry at a western university who, deprived wholly of sight by a cruel accident, has had the resolution and fortitude to continue his work as a teacher and investigator, and who has attained scientific results highly creditable to himself and to the institution with which he is connected. The search after scientific truth has the advantage that it does not depend upon externals, but rather upon the intellectual force of the individual; not upon the outward man, but the indwelling spirit.

In your chosen profession be students and productive workers always. Do not look for speedy results and do not be discouraged if the secrets of nature are not wrested from her jealous grasp without a severe struggle. The foundations of our art are broad and deep, and the superstructure should be erected slowly and with care, by accurate observation of disease and painstaking deductions. In your life as physicians be prepared for trials, disappointments and adversities. Take for your motto the words written by Sir Thomas Browne, that eminent physician, more than two centuries ago. "In this virtuous Voyage of thy Life hull not about like the Ark without the use of Rudder, Mast or Sail and bound for no Port. Let not disappointment cause Despondency nor difficulty Despair. Think not that you are Sailing from Lima to Manillia, when you may fasten up the Rudder and sleep before the Wind; but expect rough

Seas, Flaws, and contrary Blasts; and 'tis well if by many cross Tacks and Veerings you arrive at the Port; for we sleep in Lyons Skins in our Progress unto Virtue and we slide not, but climb unto it."

Have a purpose and carry it out with fortitude. There can be no more absorbing or inspiring career than is afforded by the study of medicine at the present time. The scaffolding reared by countless workers during thousands of years around the fair temple of medicine, necessary for the building doubtless, but concealing its proportions and too often defacing its beauties, has been swept away and for the first time it is permitted to us to know something of the dimensions and architectural possibilities of the completed edifice. Can there be a nobler aspiration for any man than to assist in the completion of the work of transforming the ancient art of healing into the science of medicine?

In my childhood in a far distant state I daily heard from the lips of an aged relative the story of Yale College and New Haven as she had known them at the beginning of the last century. Her tales of the many scholarly activities of the first President Dwight, of the scientific zeal and achievements of the elder Silliman, of the boundless industry in many fields of Noah Webster and of the profound learning and influence of Dr. Æneas Munson, presented ideals of life and possibilities of scholarly attainment which have remained with me ever since. Those who have been engaged in educational work here during the past two centuries can have had no conception of the silent influence which Yale has exerted upon the training of generation after generation of men throughout the whole land who have never visited New Haven nor come into personal contact with the eminent teachers who have gathered here.

Mindful of my own indebtedness to Yale, wholly indirect, I am not guilty of overstatement when I say that I regard the honor of an invitation to address you to-day as the most cherished academic event of my life. I regard the honor, however, in no sense a personal one, but deem it rather an evidence of the good will and amity which has ever characterized the relations between Yale and other schools and teachers. The university with which I am connected and which in a sense I represent to-day is equally her debtor for scholarly inspiration and example, and in her name as well as my own I would render most grateful and appreciative acknowledgment.

Henry M. Hurd.
Johns Hopkins Hospital.

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*THE NEW DEFINITION OF THE CULTIVATED MAN.**

The ideal of general cultivation has been one of the standards in education. It is the object of this paper to show that the idea of cultivation in the highly trained human being has undergone substantial changes during the nineteenth century.

I propose to use the term cultivated man in only its good sense—in Emerson's sense. In this paper he is not to be a weak, critical, fastidious creature, vain of a little exclusive information or of an uncommon knack in Latin verse or mathematical logic; he is to be a man of quick perceptions, broad sympathies and wide affinities, responsive but independent, self-reliant but deferential, loving truth and candor but also moderation and proportion, courageous but gentle, not finished but perfecting.

There are two principal differences between the present ideal and that which prevailed at the beginning of the nineteenth century. The horizon of the human intel-

* From the presidential address of Dr. Charles W. Eliot, before the National Educational Association.

lect has widened wonderfully during the past one hundred years, and the scientific method of inquiry has been the means of that widening. The most convinced exponents and advocates of humanism now recognize that science is the 'paramount force of the modern as distinguished from the antique and the mediæval spirit' (John Addington Symonds—'Culture'), and that 'an interpenetration of humanism with science and of science with humanism is the condition of the highest culture.'

Emerson taught that the acquisition of some form of manual skill and the practice of some form of manual labor were essential elements of culture, and this idea has more and more become accepted in the systematic education of youth.

The idea of some sort of bodily excellence was, to be sure, not absent in the old conception of the cultivated man. The gentleman could ride well, dance gracefully and fence with skill, but the modern conception of bodily skill as an element in cultivation is more comprehensive, and includes that habitual contact with the external world which Emerson deemed essential to real culture.

We have become convinced that some intimate, sympathetic acquaintance with the natural objects of the earth and sky adds greatly to the happiness of life, and that this acquaintance should be begun in childhood and be developed all through adolescence and maturity. A brook, a hedgerow or a garden is an inexhaustible teacher of wonder, reverence and love.

The scientists insist to-day on nature study for children, but we teachers ought long ago to have learnt from the poets the value of this element in education. The idea of culture has always included a quick and wide sympathy with men; it should hereafter include sympathy with nature, and particularly with its living forms, a sympathy based on some accurate observation of nature.

We proceed to examine four elements of culture:

Character. The moral sense of the modern world makes character a more important element than it used to be in the ideal of a cultivated man. Now character is formed, as Goethe said, in the 'stream of the world,' not in stillness, or isolation, but in the quick moving tides of the busy world, the world of nature and the world of mankind. To the old idea of culture some knowledge of history was indispensable.

Now, history is a representation of the stream of the world, or of some little portion of that stream, 100, 500, 2,000 years ago. Acquaintance with some part of the present stream ought to be more formative of character, and more instructive as regards external nature and the nature of man, than any partial survey of the stream that was flowing centuries ago.

The rising generation should think hard and feel keenly, just where the men and women who constitute the actual human world are thinking and feeling most to-day. The panorama of to-day's events is an invaluable and a new means of developing good judgment, good feeling, and the passion for social service, or, in other words, of securing cultivation.

But some one will say the stream of the world is foul. True in part. The stream is what it has been, a mixture of foulness and purity, of meanness and majesty; but it has nourished individual virtue and race civilization. Literature and history are a similar mixture, and yet are the traditional means of culture. Are not the Greek tragedies means of culture? Yet they are full of incest, murder and human sacrifices to lustful and revengeful gods.

Language. A cultivated man should express himself by tongue or pen with some

accuracy and elegance; therefore linguistic training has had great importance in the idea of cultivation. The conditions of the educated world have, however, changed so profoundly since the revival of learning in Italy that our inherited ideas concerning training in language and literature have required large modifications.

In the year 1400 it might have been said with truth that there was but one language of the scholars, the Latin, and but two great literatures, the Hebrew and the Greek. Since that time, however, other great literatures have arisen, the Italian, Spanish, French, German, and, above all, the English, which has become incomparably the most extensive and various and the noblest of literatures.

Under these circumstances it is impossible to maintain that a knowledge of any particular literature is indispensable to culture. When we ask ourselves why a knowledge of literature seems indispensable to the ordinary idea of cultivation, we find no answer except this—that in literature are portrayed all human passions, desires and aspirations, and that acquaintance with these human feelings and with the means of portraying them seems to us essential to culture. The linguistic and literary element in cultivation therefore abides, but has become vastly broader than formerly, so broad, indeed, that selection among its various fields is forced upon every educated youth.

The store of knowledge. The next great element in cultivation to which I ask your attention is acquaintance with some parts of the store of knowledge which humanity in its progress from barbarism has acquired and laid up. This is the prodigious store of recorded, rationalized and systematized discoveries, experiences and ideas—the store which we teachers try to pass on to the rising generation.

The capacity to assimilate this store and improve it in each successive generation is the distinction of the human race over other animals. It is too vast for any man to master, though he had a hundred lives instead of one; and its growth in the nineteenth century was greater than in all the thirty preceding centuries put together. In the eighteenth century a diligent student with strong memory and quick powers of apprehension need not have despaired of mastering a large fraction of this store of knowledge. Long before the end of the nineteenth century such a task had become impossible.

Culture, therefore, can no longer imply a knowledge of everything—not even a little knowledge of everything. It must be content with general knowledge of some things, and a real mastery of some small portion of the human store. Here is a profound modification of the idea of cultivation which the nineteenth century has brought about. What portion or portions of the infinite human store are most proper to the cultivated man? The answer must be—those which enable him, with his individual personal qualities, to deal best and sympathize best with nature and with other human beings.

It is here that the passion for service must fuse with the passion for knowledge. We have learned from nineteenth century experience that there is no field of real knowledge which may not suddenly prove contributory in a high degree to human happiness and the progress of civilization, and therefore acceptable as a worthy element in the truest culture.

Imagination. The only other element in cultivation which time will permit me to treat is the training of the constructive imagination. The imagination is the greatest of human powers, no matter in what field it works—in art or literature, in mechanical invention, in science, government, commerce or religion, and the

training of the imagination is, therefore, far the most important part of education.

I use the term constructive imagination, because that implies the creation or building of a new thing. The sculptor, for example, imagines or conceives the perfect form of a child ten years of age; he has never seen such a thing, for a child perfect in form is never produced; he has seen in different children the elements of perfection, here one and there another. In his imagination, he combines these elements of the perfect form, which he has only seen separated, and from this picture in his mind he carves the stone and in the execution invariably loses his ideal—that is, falls short of it or fails to express it.

Constructive imagination is the great power of the poet, as well as of the artist, and the nineteenth century has convinced us that it is also the great power of the man of science, the investigator and the natural philosopher. The educated world needs to recognize the new varieties of constructive imagination.

Zola, in 'La bête humaine,' contrives that ten persons, all connected with the railroad from Paris to Havre, shall be either murderers or murdered, or both, within eighteen months; and he adds two railroad slaughters criminally procured. The conditions of time and place are ingeniously imagined, and no detail is omitted which can heighten the effect of this homicidal fiction.

Contrast this kind of constructive imagination with the kind which conceived the great wells sunk in the solid rock below Niagara that contain the turbines that drive the dynamos, that generate the electric force that turns thousands of wheels and lights thousands of lamps over hundreds of square miles of adjoining territory; or with the kind which conceives the sending of human thoughts across 3000 miles of stormy sea instantaneously on nothing more substantial than ethereal waves. There is going to be room in the hearts of twentieth century men for a high admiration of these kinds of imagination as well as for that of the poet, artist or dramatist.

It is one lesson of the nineteenth century, then, that in every field of human knowledge the constructive imagination finds play—in literature, in history, in theology, in anthropology, and in the whole field of physical and biological research.

That great century has taught us that, on the whole, the scientific imagination is quite as productive for human service as the literary or poetic imagination. The imagination of Darwin or Pasteur, for example, is as high and productive a form of imagination as that of Dante, of Goethe, or even Shakespeare, if we regard the human uses which result from the exercise of imaginative powers, and mean by human uses not meat and drink, clothes and shelter, but the satisfaction of mental and spiritual needs.

It results from this brief survey that the elements and means of cultivation are much more numerous than they used to be; so that it is not wise to say of any one acquisition or faculty—with it cultivation becomes possible, without it impossible.

The one acquisition may be immense, and yet cultivation may not have been attained. We have met artists who were rude and uncouth, yet possessed a high degree of technical skill and strong powers of imagination. We have seen philanthropists and statesmen whose minds have played on great causes and great affairs, and yet who lacked an accurate use of their mother tongue, and had no historical perspective or background of historical knowledge. We must not expect systematic education to produce multitudes of highly cultivated and symmetrically developed persons; the multitudinous product will always be imperfect, just as there are no perfect trees, animals, flowers or crystals.

Let us as teachers accept no single element or variety of culture as the one essential; let us remember that the best fruits of real culture are an open mind, broad sympathies and respect for all the diverse achievements of the human intellect at whatever stage of development they may be to-day—the stage of fresh discovery, or bold exploration, or complete conquest. The moral elements of the new education are so strong that the new forms of culture are likely to prove themselves quite as productive of morality, high-mindedness and idealism as the old.

CHAS. W. ELIOT.

SCIENTIFIC BOOKS.

West Indian Madreporarian Polyps. By J. E. DUERDEN. Memoirs of the National Academy of Sciences, Vol. VIII. 1902.

It may seem strange that notwithstanding the thorough study that has been devoted to the skeleton of the corals our knowledge of their soft parts has been exceedingly limited until recent years. It must be remembered, however, that interest in the anatomy of the nearly related Actiniaria was not really awakened until the publication of Richard Hertwig's report cn the Challenger collection in 1882, and the technical difficulties in the way of extended anatomical study of the coral may well be advanced as an excuse for its neglect.

In the same year that Hertwig's report appeared, however, von Koch laid the foundation for a proper appreciation of the significance of the soft parts of the corals by demonstrating the ectodermal nature of the corallum, and since that date valuable contributions to the anatomy of the Madreporarian polyps have been made by von Koch himself and by Bourne, Fowler and von Heider. The total number of forms studied has, however, remained comparatively small, and although enough information was gained to demonstrate a close similarity of the Madrepores to the Hexactiniæ, yet there was a lack of sufficient data upon which general conclusions could be based. A systematic study of a large number of forms was needed, and this need has recently been supplied by Dr. J. E. Duerden in his paper on the West Indian corals, a paper destined to stand as a landmark in our knowledge of Madreporarian morphology equal in importance to that established by von Koch.

Duerden has made a thorough study of the morphology of no less than twenty-six species of corals belonging to nineteen different genera, and, when the difficulties in the way of such work are properly appreciated, nothing but admiration can be expressed for the patience, perseverance and thoroughness evidenced in every page of his work. It is monographic in its nature, considering in detail the structure, histology and development of the coral polyps as a group, and concluding with full descriptions of the special morphology of the various forms studied.

Dr. Duerden gives good reason for believing that all corals are fundamentally hexamerous, the corallum septa making their appearance symmetrically in embryos already provided with the six pairs of primary mesenteries. In some species the hexamerism becomes much obscured in later stages, while in others it is more or less distinctly preserved; and it has been possible to correlate these differences with the mode of non-sexual reproduction followed by the species. Two principal methods of non-sexual reproduction are recognizable, namely, gemmation and fission. In the former method the mesenteries of the new individual are formed *de novo* and repeat the embryological development, and consequently the hexamerism of those of the parent, while in the latter method half the mesenteries of the parent pass directly to each descendant whose growth processes are limited to an attempt to reproduce the lacking parts, a second fission frequently supervening before the attempt is carried to completion. In the polyps produced by gemmation the mesenteries present the usual hexamerous arrangement, two pairs of directives and at least four additional pairs arranged symmetrically to the

directives being present. But in fissiparous forms, since there is no tendency to reproduce directives in the regenerative growth which succeeds the division, all of the polyps of a colony, with the exception of two, will lack directives and will show little regularity in the arrangement of the mesenterial pairs.

What might be regarded as a third mode of non-sexual reproduction has been observed in the perforate corals *Madrepora* and Porites and has been aptly termed by Duerden *fissiparous gemmation,* since the mesenteries of any one polyp are partly derived directly from the parent and are partly new formations, the process in this respect resembling ordinary fission, while it also resembles gemmation in that the original hexamerous arrangement of the mesenteries and the typical number of directives are retained as a result of growth processes which precede the fission.

The careful study of the madrepores, however, has not yielded such important taxonomic results as might have been expected; their soft parts do not present as much variety as do those of the actinians. But by extending his observations over so great a number of forms Duerden has been able to establish as fundamental certain facts in the morphology of the corals which throw some light upon their position among the Anthozoa. The fact that the corallum appears only after the development of the first cycle of mesenteries seems to warrant the conclusion that the corals are derived from non-coralligenous hexamerous forms. In other words, it indicates that the Hexactiniæ, Zoantheæ and Madreporaria are all traceable to a common hexamerous ancestor, and that after the differentiation of the Zoantheæ the Madrepores and Hexactinians continued together for a time and have for a fundamental distinction only the development or non-development of a corallum. The Madreporaria are merely Hexactiniæ which secrete a corallum. This is by no means a novel view of the relationship of these two groups, but it is one that is emphasized by Dr. Duerden's careful and interesting observations.

But the question whether the derivation of the Madreporaria from the Hexactiniæ is mono- or polyphyletic still lacks a decisive answer. The uniformity of structure shown by the madreporarian polyp seems to argue for a monophyletic origin, although it by no means excludes the other possibility. It is exceedingly interesting to note that of all the actinians, those which approach nearest to the corals in structure are, as Duerden himself has elsewhere pointed out, such forms as *Actinotryx* and *Ricordea,* forms, that is to say, belonging to the stichodactyline group of actinians, having more than one tentacle arising from certain of the endocœlic spaces. And yet such an arrangement of the tentacles is not known to occur among the corals. It would seem either that the corals are derived from actinine forms with regularly cyclical tentacles, and that the similarities which the actinians mentioned above present to them are due to similar conditions of life, the actinians molding themselves over foreign bodies very much as a coral ployp is molded over its corallum, or that we may yet discover stichodactyline corals. So far as our present information goes we are justified in assuming only an actinine origin for the corals, but if, as suggested, the similarities of *Actinotryx* and *Ricordea* to the coral be due to similar life conditions, it would be easy to understand how the formation of a corallum would lead to very general uniformity of structure in forms of different ancestry, and would permit a supposition that the coralligenous forms might have arisen independently from several actinine groups.

A decision on these points must be left for future investigation, which, it is hoped, will be abundantly stimulated by Dr. Duerden's most painstaking and important work.

J. P. McM.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCE.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

THE regular meeting of the section was held on April 27 in conjunction with the New York branch of the American Psycho-

logical Association, Professor Thorndike presiding.

Professor E. L. Thorndike reported the results of extended measurements of mental traits in the two sexes. In general the females were less variable. In the case of children 9 to 12 the ratio of female to male variability was .92; in the case of children 13 and 14 it was 1.02; in the case of children 15 it was .97; in high school pupils .95; in college students .85. In the abilities measured the greatest difference found was the female superiority in the tests of impressibility, such as the rate and accuracy of perception, verbal memory and spelling. In these only about one third of the boys reach the median mark for girls.

Mr. Wm. Harper Davis read 'A Preliminary Report of Tests of Scientific Men,' dealing with some twenty physical and mental measurements made upon one hundred professional men of science, under the auspices of the Committee on Anthropology of the American Association for the Advancement of Science. No significant correlations were found between any of the tests and the several departments of scientific activity, although the cases were too few to warrant an expectation of decided results. (The superiority of psychologists in 'logical memory' was attributed to the accident that the passage used in the tests was psychological in content.) Vivid mental imagery was less common among the older than among the younger men. Two cases of color-blindness were detected.

Comparison with Columbia College students, upon whom the same measurements have been made, revealed no significant difference between the two groups, except such as would naturally arise from their disparity in age.

Critical comments were made on some of the tests and on the method of administering them. It is expected that these measurements will be continued under the direction of Professor J. McK. Cattell, who is engaged upon a comparative study of scientific men.

Mr. S. C. Parker presented a paper upon 'Correlation of School Abilities.' Several investigations in Teachers College have had for their subject 'The Correlation of School Marks.' The method and results of these researches are set forth in Vol. XI., No. 2, of the 'Columbia University Contributions to Philosophy, Psychology and Education.' This paper reports the results of some new calculations based on the marks of 245 boys in a New York City high school.

It must be borne in mind that we do not know exactly what school marks represent; they may represent real ability in the school subjects or merely the ability to get marks.

In performing the statistical work, it is important to transmute each teacher's marks separately. This point is mentioned because the neglect of it by one investigator lays his results open to question.

There is not any very great variation in the correlations between marks in academic subjects, such as the languages, sciences and mathematics. The Pearson coefficients run between 40 per cent. and 60 per cent. The correlations of drawing with academic subjects are low—lying as a rule between 0 and 25 per cent. From a psychological standpoint, the academic correlations are high. But it must be borne in mind that many constant errors enter in which would make the correlations much higher than the essential relationships would be. From an educational standpoint the correlations are low. They show the futility of the belief in general brightness for all things, and are one of the best arguments for the elective system.

Professor MacDougall read a paper on 'The Specialization of the Hand in Relation to Mental Development.'

James E. Lough,
Secretary.

Entomological Society of Washington.

The 177th regular meeting was held on April 2, 1903, nineteen members and one visitor present.

Mr. Banks reported that eleven members attended the field excursions to Bladensburg, Md., on March 26. A most enjoyable day was spent and some good specimens secured.

Dr. Dyar read 'A Note on *Pyrausta ochosalis* Fitch MS.,' a pyralid moth, showing that Fitch's species is distinct from *Pyrausta generosa* G. & R. He exhibited, further, a living larva of *Hemileuca electra* Wright, from southern California, one of the rarest of our saturnian moths. Dr. Dyar presented, also, a description of a new genus and species of moths belonging to the family Tortricidæ.

Mr. Ashmead exhibited a ceropalid (pompilid) wasp taken in Texas in the nest of the harvesting ant, *Pogonomyrmex barbatus* Smith. It constitutes a new genus and species.

Mr. Warner showed a proctotrypoid hymenopterous parasite found attached by its jaws to a specimen of grasshopper in the National Museum collection. It is a species of the genus *Scelio*, the members of which are parasites of grasshoppers' eggs, and have a habit of attaching themselves to gravid female grasshoppers and waiting for them to oviposit.

Dr. Hopkins reported some observations he had made recently in North Carolina upon (1) certain dipterous galls found on pine at Asheville, and (2) the damage inflicted upon girdled cypresses, sweet gums and black gums by ambrosia beetles.

Mr. Heidemann exhibited a specimen of the aradid bug, *Neuroctenus pseudonemus* Bergroth, collected at Bladensburg, Md., under bark, and not previously recorded from the vicinity of the District of Columbia.

Mr. Banks showed a specimen of the syrphid fly, *Ceria willistonii* Kahl, reared from the puparium at East End, Virginia. It is new to that locality. The adult resembles a fly of the family Conopidæ, or some wasp. He exhibited, also, two rare ortalid flies which resemble ants in appearance, *Myrmecomyia myrmecoides* Loew and *Odontomera ferruginea* Macquart.

Dr. Howard described some recent experiments carried on in Brazil for the purpose of testing the correctness of the conclusions of the U. S. Army Commission in regard to yellow fever. These experiments have been generally accepted as conclusive, and have removed all incredulity as to the fact that mosquitoes play a part in the transmission of yellow fever.

The following papers were presented: 'A Revision of the Boreal-American Species of *Nonagria* Ochs,' a genus of noctuid moths, by John B. Smith; 'Some Remarks on Genera in the Mutillidæ' (sand wasps), by William H. Ashmead; 'A Review of the North American Species of the Lepidopterous Family Anthroceridæ' (Zygænidæ), by Harrison G. Dyar.

ROLLA P. CURRIE,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

THE GRAND GULF FORMATION.

TO THE EDITOR OF SCIENCE: In response to the clear and courteous exposition of their present ideas of what constitutes the Grand Gulf formation, by Messrs. Smith and Aldrich (SCIENCE, July 3, pp. 20–26), I may say: (1) That I withdraw the opinion that it is not new; now that I understand it clearly, I regard it as an absolutely new view; (2) that so far as observed facts are concerned I am far from wishing to be understood as questioning the existence of a deposit of unfossiliferous clay which contains irrecognizable traces of vegetable matter, which has a wide distribution as claimed by these gentlemen, and lies above the Chesapeake Miocene and below the so-called Lafayette, from which it is not separated, where I have observed it, by any unconformity or characteristic peculiarity. I would recall the fact that I have personally no knowledge of the 'Grand Gulf' except what I have derived from such excellent authorities as Wailes, Hilgard, Smith, Langdon, Professor G. D. Harris, Miss Maury, etc., from their published writings and observations in the field. My office has been, after making field studies of the fossiliferous Tertiary, especially the Chattahoochee and Chipola sections, to endeavor to correlate with horizons of known age in the marine series, the fresh- or brackish-water formations almost destitute of fossils, laid down about the margin of the Mississippi embayment during a long period of Tertiary time, which have been named by the geologists above mentioned, and to which, so far, no satisfactory key has been found.

The difference of opinion, therefore, between Messrs. Smith and Aldrich and myself is in regard to *names* and their application merely, and not a calling in question of the accuracy of any observation made by them.

It is an acknowledged fact, I believe, that at least since the period of the Vicksburg sedimentation, a considerable part of the shores of the Mississippi embayment have been and still to some extent are the seat of a sedimentation of alluvial material in fresh or brackish water containing fragments of vegetable matter converted into lignite, and from which only a few rare specimens of fresh-water molluscan fossils, turtle shells, etc., have been obtained in half a century. The rarity of fresh-water shells is proof that the marshes or lagoons could not have been purely fresh-water areas, the absence of oysters, etc., shows that they were not permanently brackish, and we are forced to offer the hypothesis that fresh and salt water so alternated over the area concerned, that inhabitants of neither were able to maintain a footing and that the organic remains found are either drifted from elsewhere or the product of extremely local and temporary conditions.

The earlier deposits of this kind, other things being equal, we should expect to, and I believe we do find at the greatest distance from the sea and in the most consolidated state; though a comparatively recent transgression has carried unconsolidated sediments over a large part if not all of the antecedent deposits. Now it seems to me that in their interesting communication Messrs. Smith and Aldrich have momentarily forgotten the history of research on this perplexing question. Let us very briefly review it.

The Grand Gulf sandstone, a rock 'superior in hardness to granite itself' was first named by Wailes in 1854, who specifies as a typical exposure that on the banks of the Mississippi, at Grand Gulf, Claiborne Co., Miss., from which the formation was named. Hence in the allocation of names to portions of the sediments which have since been hastily included under it, we must reserve for this particular horizon the name of Grand Gulf. Wailes believed that more tractable rocks to the eastward were identical with this sandstone, but everywhere it is described by him as a rock, a hard or massive sandstone, suitable in its softer phases for building stone, millstones, etc. Beyond the Mississippi this sandstone reappears in Louisiana, and according to Miss Maury extends across the state and as far as the Brazos River in Texas. To the eastward near Oak Grove, Florida, the typical sandstones according to Professor Harris and Miss Maury 'pass beneath the (Oligocene) Oak Grove sands, indicating that the sandstone is approximately of the same age as the Chattahoochee.'* In Alabama the typical sandstone is rare and the series corresponding 'usually consists of clayey sands or joint clays' according to the same authority.

In 1860 Hilgard, in his valuable report on the 'Agriculture and Geology of Mississippi,' considerably enlarged the scope of the formation, taking in clays, sands, consolidated and unconsolidated, over a large area of country. Later, as mentioned in my last communication, he came to the conclusion that the series included a succession of sediments of ages between the Vicksburg and the drift. The fact that at the typical locality the flinty sandstone is succeeded by the unconsolidated Lafayette or Orange Sand, is of course no evidence of continuous sedimentation without a break between the two, such as appears to be the case in the aluminous clay of the Chattahoochee, where no distinct line of demarcation is visible between the latter and the so-called Lafayette conformably above it.

As one of the problems to be solved this state of things has long attracted the attention of the few geologists working on the southern Tertiary. Some fifteen years ago I received from Professor Smith what were hailed as fossils at last from the Grand Gulf sands of Roberts, Ala., a horizon which in 1894 Professor Smith included in the Grand Gulf formation.† They were very imperfect but fortunately contained one identifiable characteristic Oligocene species of the Chipola horizon. Subsequently Mr. L. C. Johnson obtained from what he pronounced to be

* *Bull. Am. Pal.*, No. 15, p. 70, 1902.

† 'Coastal Plain of Alabama,' p. 102.

Grand Gulf strata near Vernal, Miss., another series of fossils which I was able to determine as of late Chesapeake or early Pliocene age, and which were then eliminated from the so-called Grand Gulf and placed by Professor Smith at the top of the Miocene with the name of the Pascagoula formation (*op. cit.*, p. 94).

In 1894 Professor Smith expressed himself in regard to the 'Grand Gulf' in the following language: 'The barren Grand Gulf sands pass towards the east into the marine deposits of the Chattahoochee (Oligocene) which are their time equivalent' (*op. cit.*, p. 17) and 'The underlying division of the Grand Gulf * * * its position is identical with that of the Chattahoochee limestone of Mr. Langdon, and there is no room for any reasonable doubt about their identity in age' (*op. cit.*, p. 106).

Since that time Professor Harris and his party of students have traced typical 'Grand Gulf' sandstones beneath the Oak Grove Oligocene sands near Oak Grove, Santa Rosa County, Florida, as already mentioned.

I have no prejudice as to the application of the name Grand Gulf to any particular series to which it can be shown to belong, but I am not convinced that Professor Smith and Mr. Aldrich, in restricting the name in the manner and to the stratum now proposed, have shown proof of its identity with the original formation described by Wailes. I feel certain that the Pleistocene age of Wailes' formation is unproved. I believe it to be unlikely, and, in view of the record as above summarized, I feel justified in referring it, as heretofore, to the upper Oligocene, pending more exact and ample information.

WM. H. DALL.

SMITHSONIAN INSTITUTION,
July 6, 1903.

ANSWER TO PROFESSOR COCKERELL, REGARDING HIGHER EDUCATIONAL INSTITUTIONS OF NEW MEXICO.

TO THE EDITOR OF SCIENCE: Professor T. D. A. Cockerell has made some statements in his article on the condition of affairs at the New Mexico Normal University which appeared in your columns May 8, which seem to me can hardly be passed without notice. I do not care to discuss the matter which Professor Cockerell presents concerning the conditions at the College of Agriculture and Mechanic Arts or at the Normal School at Las Vegas. It is always unfortunate when there is a lack of harmonious relations between a board of regents and the president or faculty of any institution, and still more unfortunate when such relations are the result of political influences. There is no doubt but at times great injustice results to individuals and great harm to the institution and the broader cause of education. Few institutions of any considerable age have not had some differences arise between their managing boards and their faculties at some time in their history, and no institution can boast that its organization is such that it is entirely safeguarded against any such unfortunate condition in the future. It must be recognized, however, that such breaches in the harmonious administration of the affairs of an institution are usually very short-lived. The organization of our public institutions may be such that they are more susceptible to such outbreaks than others, but it is to be doubted. In the public institution it is usually politics which interferes; in private institutions it is personal prejudice; in denominational schools it is denominational creed or religious difference. The character of the factor may vary, but the result is nearly the same. In all such cases it can usually be shown that some one has abused the powers and privileges of a position of authority. In public institutions all parties, from the governor, who usually holds the appointing power to membership on the board of regents, down to the student in the class-room, are servants of the people, and all are working under a regularly established system of laws. These laws determine the authoritative ranking of each. Each party has a duty to the subordinate elements of the organization, and an obligation of obedience to the superior in rank. In most institutions these duties and obligations are usually well defined by law.

In passing judgment upon any particular case these broad relations should be kept in mind, and in what I have to say I do not wish to be understood as expressing any opinion concerning the conditions which have existed at the Agricultural College in the past, or at the Normal School at the present time. There are, however, two points in Professor Cockerell's communication to which I desire to call especial attention. Not that the professor has intentionally misrepresented the matter, but because of the inference which might easily be drawn. The conditions in two of the several public institutions of the territory are made the basis of several broad and general inferences. I am assured by President Light of the Normal School of Silver City that the relations of the board of regents of that institution and the faculty have been uniformly harmonious, and that the institution is wholly free from political influences in its administration. Professor Cockerell states in his article that the Normal School at Las Vegas '*has had until now a most fortunate immunity from political interference.*' And I wish to state that it has never been my pleasure to know of a public institution so free from political influences as the University of New Mexico, over which I have the honor to preside.

Again, Professor Cockerell says: 'It can not be overlooked that the governors of New Mexico, who appoint the regents of the higher institutions, are responsible for the general unsatisfactory character of these bodies.' I wish to object to the professor's use of the term 'general' and 'these bodies,' and to state that, at least in the case of the University of New Mexico, a more estimable body of men could not be selected from any community either in this territory or any of the eastern states of the Union.

Hon. Ex-Governor E. S. Stover has always been a staunch friend of education. Hon. F. W. Clancy is one of the old and leading attorneys of the city of Albuquerque. Dr. James H. Wroth is one of the leading physicians of the city and surgeon for the Santa Fe Railroad. Hon. Henry L. Waldo, of Las Vegas, is general solicitor for the Santa Fe Railroad and ex-chief justice; and Hon. E. V. Chavez is another of the leading attorneys of Albuquerque. There are three Democrats and two Republicans. These men are all appointees of governors of New Mexico, and three of them originally by Governor Otero, and all have been reappointed by him at the expiration of their terms.

As to the other institutions of the territory, I can only say that their boards, as far as I know, are made up of men who are leading and influential citizens.

In closing, permit me to say that, in my judgment, the higher institutions of learning of the territory of New Mexico are in general fully as free from political influences as are those of any other state of our Union, and it is hardly right to take the exceptional unfortunate cases of disorder as indicative of the general condition.

W. G. Tight.

University of New Mexico,
Albuquerque, N. M.

THE PROPOSED BIOLOGICAL STATIONS AT THE TORTUGAS.

To the Editor of Science: Referring to the correspondence from zoologists as to the need for one or more stations for biological research work in southern waters, I notice the preponderance in favor of Tortugas. Aside from its suitability for deep-sea fauna there seem to be other items to commend it, such as: The flag which floats over it, available buildings, subsistence, accessibility and, not the least in importance, communication. It may not be known to the committee or to your readers that the United States government departments are planning a chain of wireless telegraphic communication along the coast and to the Antilles. Among those now installed are stations of the De Forest Company at Hatteras and Porto Rico; others are proposed at Miami, Key West, Havana, etc. These will be in demand for commercial marine as well as naval and military purposes.

A glance at the map will show that Tortugas can easily be hitched on to this system *viâ* Key West (and equally a station at Cul-

ebra *viâ* San Juan) with very little added cost or trouble. No cable will be required, but only a mast and some sort of light motor. The operator could be improvised easily by one of the resident staff familiar with the Morse code. The greater comfort and convenience of life with this facility at hand would be cheaply purchased.

I am assured by the executive of the American De Forest Company—whose office is at 100 Broadway—that they would welcome the establishment of a science station near their field and cooperate in any reasonable way for the handling of any commercial business that might come that way.

Believing that this suggestion may have further weight in the deliberations, I forward this with the concurrence of Dr. De Forest's organization.

R. T. COLBURN.
ROOM C, 120 BROADWAY, NEW YORK.

SHORTER ARTICLES.

SOME OF THE DANGERS OF FORMAL.

So much use is being made of formal* in the conservation of anatomical and zoological specimens, as well as for purposes of disinfection, and it has become so readily accessible to persons unfamiliar with some of its dangerous properties, that it may not be amiss to point out some of these. Of course every one who works with formal has experienced the disagreeable coryza and coughing arising from the inhalation of the fumes of this drug, as well as the irritating effect upon the ocular conjunctivæ. Although no fatal case of poisoning by inhalation has been recorded, one may take warning from the experimental results of M. H. Fisher,† who found that the exposure of various animals (guinea-pigs, rats, cat and dog) to the fumes of formaldehyd for one or one and a half hours produced in them a fatal pneumonia, tracheitis and bronchitis, after only three grams of paraformaldehyd had been volatilized in the room. Only recently, in this city (New York) a woman was overcome by formal fumes. Her younger child had had diphtheria; the disinfecting was done in the afternoon and the family moved in again about seven o'clock. The odor was still strong, but the woman thought it would pass away and went to bed. Later she awoke with her head ringing, and was just able to crawl to the hall and summon help. The children were not ill at all. The writer has noticed in himself, after working in an atmosphere fairly charged with formal fumes, a state of depression and dulness which does not wear off until after spending some time in fresh air. A long exposure might bring about a serious condition, though Kenyon* expresses it as his belief that the vapor does not endanger inhabitants of rooms, and cites an experiment on a calf kept in an atmosphere of two per cent. formaldehyd for five hours, which only produced a slight cough and some watering of the eyes, both symptoms disappearing on the animal's going into fresh air.

The effect of formal on the skin is well known.† The cuticle is killed; it hardens, cracks and desquamates; in some individuals this is attended by an eczematous rash. The nerve terminals in the skin are paralyzed, producing an annoying numbness. Where the skin is cracked, the entrance of formal becomes very painful.

The palpable influence of formal on the glandular action of the skin led Dr. E. C. Spitzka to recommend it in two instances where patients consulting him mentioned their being affected with the annoying condition of perspiring hands and feet. They began with a dilute solution used as a wash several times a day, and gradually increasing its strength, not exceeding one of ten per cent. of the commercial preparation. In both cases the effect was gratifying after two or three weeks, and in one of them the permanency of the cure seems guaranteed by the non-return of the trouble for three years thereafter.

To laboratory workers one of the great dangers is the accidental splashing of drops

* On the use of *formal* as a term more suitable than *formalin*, *formol* or *formalose*, cf. B. B. Stroud's papers in *The American Naturalist*, January 1 and May 1, 1897.

† M. H. Fischer, 'The Toxic Effects of Formaldehyd and Formalin,' *Jour. of the Boston Soc. of Med. Sci.*, Vol. 1, October 16, 1900.

* F. C. Kenyon, SCIENCE, VI., 1897, p. 737.

† W. H. Dall, SCIENCE, VI., 1897, p. 633.

of formal into the eye. This occurred once to the writer, and the experience was certainly the most intensely painful in his recollection. Fortunately, the affected eye could be bathed almost immediately with a stream of running water and the irritant had not hit the cornea, else this transparent portion of the external tunic of the eye would undoubtedly have been rendered more or less opaque. Where the irritant had come in direct contact with the ocular conjunctiva, an almost immediate and intense congestion appeared, accompanied for several hours by an exquisite pain. In Fischer's experimentation on animals it was determined that a single drop of the concentrated solution introduced into the conjunctival sac is sufficient permanently to injure the eye. A contraction of the pupil to pinhole size follows, and atropine fails to dilate it again.

The toxic effects of formal which is accidentally swallowed are so profound that a timely word of warning may not be uncalled for. Medical literature contains quite a number of cases, of which the following brief accounts will convey some idea.

(*a*) Bock* reports the case of an inmate of the Indian School for Feeble-minded Youth, aged twenty-six, strong and healthy, who took, while unobserved, about two ounces of concentrated formal. There was early vomiting with traces of blood; collapse and unconsciousness ensued; heart-failure occurred after sixteen hours, and drugs failing to stimulate the depressed vital functions, the patient died in twenty-six hours. A post-mortem examination showed the stomach to be highly inflamed, necrotic and œdematous, and containing about four ounces of dark fluid.

(*b*) Klüber† had a patient who took a draught from a bottle labeled 'Apenta' water, which he afterwards described as 'tasting like gall.' The patient became unconscious, passing into a state resembling that of alcoholic intoxication or of a post-epileptic condition; the urine was suppressed for nineteen hours, and when it appeared was scant and gave the reaction for formic acid. He recovered in a few days, owing to the prompt and careful treatment.

(*c*) Zorn* describes the case of a porter, aged forty-four, who swallowed about half the contents of a medicinal glass of 30 c.c. capacity, in the belief that he was taking 'Hoffmannstropfen.' The burning taste made him aware of his mistake and he swallowed some milk. This was followed by terrible retching and vomiting, then unconsciousness. The pulse and respiration rose rapidly in frequency, the temperature fell, and the urine was suppressed for twenty-four hours. Other symptoms pointed to a parenchymatous irritation of the kidneys and of the gastro-intestinal tract.

(*d*) Gerlach† had a patient, a servant girl, aged twenty-one, for whom he had prescribed (*a*) formal mouth-washes and (*b*) a solution of potassium iodide, in the treatment of thrush (stomatitis). The two bottles stood near each other, and the girl, on retiring, mistaking one for the other, took nearly 60 to 70 c.c. of the concentrated formal. Unconsciousness, collapse, etc., ensued, and only the prompt emptying of her stomach by the physician averted a fatal ending of the case. Anuria persisted for twelve hours.

(*e*) Testi‡ reports the case of a man who by mistake swallowed a mouthful of a forty per cent. solution of formaldehyd. The chief symptoms were intense pain after swallowing, followed by vomiting, intense congestion of the face, conjunctivæ, fauces and tonsils. For two or three days his condition remained unchanged; he was unable to swallow anything but the smallest quantity of liquid. Two large eschars formed on the fauces and tonsils. Unlike most of the cases cited above, there was no general stupor, anuria or the modifications of pulse, temperature and respiration, which may be accounted for upon the ground that the prompt vomiting prevented absorption of the poison into the system, its effect being purely local.

* C. Bock, *Indiana Medical Jour.*, XVIII, 1899–1900, p. 122.

† Klüber, *Münch. med. Wochnschr.*, 1900, p. 1416.

* Zorn, *Münch. med. Wochnschr.*, 1900, p. 1588.

† Gerlach, *Münch. med. Wochnschr.*, 1902, p. 1503.

‡ Testi, *Il Policlinico*, IX., 8, December 20, 1902.

The effect of even minute quantities, such as the dairymen began to employ in the preservation of milk (1:20,000), has been shown to be a harmful one, in the long run, at all events. Whether this is due to its influence on the proteids of the milk or upon the enzymes of the digestive tract, is not rendered quite clear as yet, but that digestion is interfered with, particularly the pancreatic digestion of albumen, is determined with certainty.

The above enumeration of some of the dangers of formal shows that the accidental swallowing of the drug is perhaps the greatest, particularly as the outcome of any case differs very much in different individuals and under different circumstances. Even the prompt medical aid given in the first case cited above failed to avert death, and the careful guarding of this drug from coming into the hands of the inexperienced or the irresponsible devolves upon every one in charge of laboratories, factories, farms, hospitals and other places where formal is used. Every bottle or other receptacle containing formal should be distinctly labelled 'POISON.' A few words, in conclusion, on the initial treatment of a case of acute formal poisoning may be found useful. The strong affinity of formaldehyd for ammonia gives a hint of therapeutic value.* The aromatic spirits of ammonia in doses of from one half to two fluid drachms, or even somewhat more, according to the amount of formal swallowed; or the liquor ammonii acetatis (spirit of Mindererus) in half-ounce doses, should be taken immediately as an antidote for the local effects. A physician should, of course, be sent for. Vomiting should be promoted, and the stomach washed out several times through a tube. The constitutional symptoms of depression of the vital functions must be met by the use of stimulants such as strychnine or caffeine. The patient must remain in the recumbent position, and external heat, by means of hot-water bottles, or by frequent lukewarm baths, should be applied. Demulcent drinks in small quantities frequently given allay the irritation. Food can not be taken for some time.

E. A. SPITZKA.

* Bastedo, article, 'Formaldehyd,' in 'Buck's Ref. Handbook of the Medical Sciences,' 1902.

QUOTATIONS.

THE AMERICAN METHOD OF APPOINTING UNIVERSITY PROFESSORS.*

I AM wrestling at the moment with a mass of correspondence which has accumulated during an eighteen weeks' absence in America. Among the letters demanding my immediate attention are several from friends requesting 'testimonials' regarding their fitness to fill professorships which are now vacant. These applications bring into sharp relief important differences between the old country and the new, in point of academic etiquette or custom. I think that the principle involved is a matter of public concern. The superiority of the new country's practice in the matter of appointing academic officers is, to my mind, so manifest that I am sanguine enough to believe that dissemination of knowledge about the newer system will lead at no distant date to the abrogation of the older.

In America I visited a score of the leading universities, including such veteran foundations as Harvard, Yale and Princeton, and such modern institutions as Johns Hopkins, Cornell and Chicago. Among many other topics which I discussed with university presidents and professors of standing was the mode in which vacancies in the various faculties were supplied. The method in universal vogue on the other side of the Atlantic is entirely unlike the usage familiar on this side, though there are resemblances between the American method and that employed by ministers of the crown in nominating regius professors.

Appointments to all vacant offices in an American university are made by the president, on what may be regarded for practical purposes as his sole authority or responsibility. (At the same time the president's action is always liable to control or check by boards of trustees or regents, who are usually sagacious men of position in the professions or in commerce.) As soon as a vacancy arises in

* From the London *Times*.

the professorial staff, the president consults members of the faculty concerned. He invites their opinion as to who is the fittest man to fill the vacant chair. But the president does not confine his inquiries to his immediate circle of colleagues. University presidents and professors in America constitute almost a caste of their own. By virtue of well-organized clubs and associations, which cover the great continent like a network, they keep closely in touch one with another. Knowledge of the reputations that men are acquiring in academic work is wonderfully well diffused. The president who is seeking to fill a vacant chair has at command ready means of communication with presidents and professors of other universities. He is usually in correspondence with foreign scholars and teachers. He neglects no opportunity of collecting evidence as to the qualifications of professors, assistant professors and instructors in various parts of his own country. Finally, after due and thorough investigation, he forms his decision as to how the vacant post may be filled with greatest advantage to the institution over which he presides. He forwards an invitation to the chosen person to occupy the vacant office. The wisdom of his choice is rarely, if ever, questioned.

At every stage the election is the antithesis of a public contest. There are no self-nominated candidates. Consequently no one is defeated and no one triumphs over another. Everybody's feelings are scrupulously respected. The preliminary inquiries are pursued in the strictest confidence. Most important of all, no open advertisement on the part of either elector or elected is permitted. Every American professor with whom I spoke on the subject deemed it an intolerable strain on a scholar's proper modesty to require him to nominate himself for election, to describe his own attainments, to print a statement of his qualifications for a vacant office. Still more repugnant to the American code of academic ethics is it for a would-be professor to invite his acquaintances to eulogize his character or his writings with a view to circulating 'testimonials' in printed pamphlets. Such conduct is generally held in the United States to be ignominious. Testimonial-hunting, as it is pursued in this country would prove a fatal bar there to promotion of any reputable kind.

The only argument that I have heard advanced in favor of the British system, whereby everybody is at liberty to offer himself for election for a vacant professorship, to declare his own merits, and to solicit confirmatory compliments from his friends, is that the elector's field of choice is thus usefully enlarged. But this argument is open to most serious question. Men of ordinary sensitiveness often refuse to submit themselves to the humiliating ordeal of public or semi-public competition for a vacant professorship, which in many respects reduces them to the level of advertising vendors of quack medicines. In effect the prevailing system often narrows the field of choice open to the electors, who are not in the habit of looking outside the panel of self-appointed candidates; it is, indeed, doubtful if honorable regard for the terms of their public advertisement permit them such a course of action.

It ought to be an easy matter for the heads of colleges and universities in Great Britain to adapt the American method to home requirements. The difficulties incident to the enormous area and population of the United States and to the vast and increasing number of academic institutions which are worthy of consideration there, are not present in this country. To pronounce the American system unworkable here is a confession of inferiority, from the point of view alike of ethics and practical efficiency, about which one would prefer to be silent.

Sidney Lee.

108 Lexham-gardens, W.,
June 3, 1903.

CURRENT NOTES ON METEOROLOGY.

THE CLIMATE OF BENGUET, PHILIPPINE ISLANDS.

"There is no region in the United States which has a more healthful or delightful climate than is afforded by the Benguet highlands, where a white man can perform heavy field labor without excessive fatigue or in-

jury to his health" (*Nat. Geogr. Mag.*, May, p. 203). "Great province. This is only 150 miles from Manila, with air as bracing as Adirondacks or Murray Bay. Only pines and grass lands. Temperature this hottest month in the Philippines in my cottage porch at three in the afternoon, 68° F. Fires are necessary night and morning" (Cablegram from Governor Taft to the Secretary of War, dated April 15). These are two recently published statements regarding the climate of the highlands of Benguet, in the northern part of the island of Luzon. Such broad general statements are misleading. They tend to spread false notions regarding the possibility of the acclimatization of the white race in the Philippines, and of outdoor work by white men in a tropical climate. Altitude, as in the highlands of Benguet, or of India, gives some relief in the way of lower temperature than at sea level. It means the absence of some tropical diseases which prevail on the lowlands, or a more rapid recovery from these diseases than at sea level. But all experience shows that altitude does not solve the acclimatization problem. A tropical sun is always a tropical sun. A tropical climate is always a tropical climate. It should be the aim of all Americans who send us accounts of Philippine climates, avoiding generalities based on first impressions, carefully to study the effects of the climate upon white men. The experience of English, French, Germans and others in the tropics furnishes evidence enough of the inaccuracy of much that has been written of the climate of the Philippines.

THE RECENT FLOODS.

THE disastrous floods of March, April and June on the Mississippi and Missouri Rivers naturally attracted much attention in the daily papers. Along the lower Mississippi River the March-April flood of the present year was the greatest on record if stages of water alone are considered, although the actual volume of water was probably less than in the flood of 1897, the greater heights in 1903 being the result of the extension of the levee system. The rise of the Ohio and lower Mississippi Rivers was steady during February, owing to several heavy general rains, and during the last two days of the month another storm moved northeastward through the Ohio valley, making it certain that floods would occur. Other heavy rains occurred on March 7 and 8. The flood warnings of the Weather Bureau were timely and accurate. The stages which were forecasted, and those which were actually recorded, between Cairo and New Orleans are shown in the following table, taken from an article by H. C. Frankenfield on 'The Weather Bureau and the Recent Floods' (*Nat. Geogr. Mag.*, July, 1903).

Stations.	Forecast Stage (ft.).	Actual Stage (ft.).
Cairo	50.5 to 51	50.6
Memphis	40.0	40.1
Helena	51.0	51.0
Arkansas City.	53.0	53.0
Greenville	49.0	49.1
Vicksburg	52.0	51.8
New Orleans...	21.0	20.4 to 20.7

At Cairo the forecast was four days in advance, and at New Orleans twenty-eight days in advance of the crest.

At the end of May and early in June the floods on the lower Missouri and the upper Mississippi were greater than any on record except that of 1844. They resulted from heavy daily rainfalls over Kansas, coming in connection with persistent low pressures over the eastern slope of the Rocky Mountains. Similar conditions prevailed eastward into northwestern Missouri and Iowa. At St. Louis warnings were issued on June 5 of a stage of thirty-eight feet in about four days. That stage was exactly reached on the fifth day.

RAINFALL AND SUNSPOTS.

DR. W. J. S. LOCKYER continues his investigation of rainfall and sunspot cycles (*Nature*, Vol. 68, pp. 8–10). Smoothed rainfall curves for the British Isles, Brussels, Madras, Bombay, Cape Town and the Upper Ohio valley show a long-period variation at all the stations, and further, the occurrence of the greatest rainfall generally in the years 1815, 1845

and 1878–83, with the minima about the years 1825–30, 1860 and 1893–5. A continuation of the curves, based on the assumption that the apparent law already recognized holds good, indicates that the year 1913 will be at about the middle of the next wet epoch. The sunspot curve shows a close correspondence with the rainfall curves. There appears to be a long-period solar change of thirty-five years, the minimum of sunspots corresponding roughly with the maximum of rainfall. Dr. Lockyer concludes that 'since this long-period rainfall cycle synchronizes so well with the solar changes, the latter may render valuable assistance in determining the epochs of these dry and wet cycles.'

R. DeC. Ward.
Harvard University.

Opening of the Lake Laboratory of the Ohio State University.

On the afternoon of July 2, the new Lake Laboratory building of the Ohio State University, located on Cedar Point, Sandusky, Ohio, was formally opened. Several scientists from the various institutions of the State were present at the exercises, while many of those unable to be present responded with letters of congratulations and well-wishes. The director, Professor Herbert Osborn, opened the session by reading extracts from these letters, after which the first speaker of the day, Professor C. J. Herrick, of Denison University was introduced. Professor Herrick spoke on the Summer Laboratory as an instrument of scientific research. He took the stand that such institutions fulfil their functions not merely by giving investigators facilities and materials for research, but particularly in the culture of the investigators themselves. Exchange of ideas and consequent broadening of view is an important point in the consideration of the value of summer laboratories. The speaker expressed a hope that the several scientific institutions of the state would cooperate with the State University in making the laboratory an institution of the highest usefulness and gave assurance that such would be the policy of the colleges and universities of Ohio.

Hon. J. T. Mack, of Sandusky, a member of the Board of Trustees and representing that body, outlined the policy of the university with respect to the laboratory and emphasized the fact that it is a laboratory for the use of the scientific men of the state, regardless of their affiliations.

Captain Alexis Cope, secretary of the university, gave a detailed history of the laboratory as shown by the archives of the university. The idea of such an institution originated with the late Dr. Kellicott, in 1894. During the succeeding year, appropriations were made for an addition to the State Fish Commission building in Sandusky, the whole of which could be used during the summers as a lake laboratory. In 1899 the present director, Professor Osborn, made a request to the board for a more commodious building and recommended that it be erected on Cedar Point which is a tongue of sand twelve miles long and a few hundred feet wide at most. This was favorably received and the present building is the outcome.

Professor Denny, dean of the College of Arts of the University followed this speaker with the theme 'Comradeship in Science.' Men of science should associate with one another, as by so doing they become inspired to greater efforts and disappointments are belittled as they see how others meet and overcome difficulties. The dean said that the laboratory was a part of the university and that full credit would be given toward degrees for work done.

The director, Professor Osborn, concluded the program by thanking the friends of the institution and those that have acted as its promoters. The professor gave briefly a history of summer laboratories, tracing their origin to Penekese and Agassiz. He said that a new life is put in biological work by the founding of such institutions in that live material and natural environment is had in easy access. The director reiterated the desire expressed by another speaker that the laboratory would become, as its expressed purpose is, an open meeting ground for all biological workers of Ohio and adjacent states.

SCIENTIFIC NOTES AND NEWS.

THE University of London conferred honorary degrees for the first time on June 24, the degree of Doctor of Laws being given to the Prince of Wales, of Doctor of Music to the Princess of Wales and of Doctor of Science to Lord Kelvin and Lord Lister. The chancellor, Lord Rosebery, stated that the conferring of honorary degrees would not be an annual celebration, and that it was intended to make the degree of the University of London 'the most rare and the most precious in the annals of any university.'

DR. JOSEPH LARMOR, Lucasian professor of mathematics at Cambridge, received the degree of Doctor of Science from Dublin University on June 30.

PROFESSOR C. J. MARTIN, F.R.S., of the University of Melbourne, has been appointed director of the Jenner Institute of Preventive Medicine, London.

DR. LUTHER H. GULICK, director of physical training of the public schools of New York City, has been elected president of the National Physical Education Association.

DR. O. H. TITTMANN, superintendent of the United States Coast and Geodetic Survey, will sail for Europe on the steamship *Blücher* on July 23, to represent this government at the conference of the International Geodetic Association, which will meet this year in the Danish Parliament building at Copenhagen, on August 4. After the adjournment of the conference Dr. Tittmann will go to London and hold himself in readiness to assist the members of the Alaskan boundary tribunal, consisting of Secretary Root, Senator Lodge and ex-Senator Turner.

PROFESSOR F. W. PUTNAM is now on his way to California, where he is chairman of the committee on anthropology in the University at Berkeley. He has recently been made honorary member of the Royal Academy of Literature, History and Antiquities of Stockholm; corresponding member of the Berlin Anthropological Society; honorary member of the California Academy of Sciences and of the Missouri Historical Society.

H. G. TIMBERLAKE has been appointed a research assistant in botany in the Carnegie Institution for the coming year. He has been granted a year's leave of absence by the regents of the University of Wisconsin, where he was promoted to an assistant professorship in June.

LEROY ABRAMS, of the Stanford department of systematic botany, is doing field work in southern California for the New York Botanical Garden.

DR. F. W. CRAGIN, of the department of geology of Colorado College, has received from some public-spirited citizens of Colorado and other western states a grant of funds to enable him to conduct special researches in the early history of the Rocky Mountains and Great Plains; a subject in which, during the past five or six years, he has built up quite an extensive library. Intending to lay aside, for several years at least, the profession of teaching, he has resigned his chair in the college, and will give his chief energies to the historical work. He will devote a considerable part of the coming year to travel in the interest of these researches. He states that in appointing his successor, it is the desire of the trustees of Colorado College to secure, if possible, a man who combines a thorough knowledge of metallurgy with that of geology.

The Journal of the American Medical Association states that the friends and pupils of the recently deceased Professor E. Bottini had planned a 'Festschrift' in his honor with a gold medal and souvenir copy of his diploma on the occasion of his jubilee anniversary. The anniversary came soon after his death, and the University of Pavia was made the recipient of the honors in his name, the medal, diploma and 'Festschrift' to be duly preserved among the archives of the institution with the list of subscribers.

PROFESSOR S. W. WILLISTON, of the University of Chicago, president of the Sigma Xi Society, addressed the chapter of the society at the Ohio State University on June 22.

GOVERNOR LANHAM, of Texas, has issued a proclamation offering a reward of $50,000 from the state to any person who discovers

a practical method for eradicating the cotton boll weevil.

The Bufalini prize of the University of Florence will be awarded at the end of October of next year. This prize is of the value of $1,200 and is awarded once every twenty years. The subject is the value of the experimental method in opposition to the speculative or dogmatic method of scientific research.

The National Educational Association held a very large and successful meeting at Boston last week, there being a registration of some thirty thousand members.

The legislative council of Ceylon has invited the British Association for the Advancement of Science to meet in Colombo in 1907 or 1908.

The Swiss Society of Natural Sciences will hold its eighty-sixth session from the second to the fifth of September at Locarno. In connection with the society, which corresponds to the American and British Associations for the Advancement of Science, there are meetings of the Swiss societies of geology, botany, zoology and chemistry, and probably of the Zurich Physical Society. The society always provides a full program of entertainments and excursions, and the place of meeting this year is especially inviting to foreigners.

With the intention of fixing upon a proper forest policy, California has undertaken this year, with the help of the Bureau of Forestry, a comprehensive and detailed study of its forests. The state legislature recently appropriated $15,000 for the study, the condition being that it should be carried out by the Bureau of Forestry, and that the bureau should bear half the expense.

A cablegram from Berlin to the daily papers states that the official report of Professor Drygalski, of the German Antarctic expedition, was published on July 11. The report gives details of the movement of the expedition's vessel *Gauss* between January 31, 1902, and June 9, 1903, on which the *Gauss* reached Simonstown, South Africa. A number of newly discovered points were christened, one being Pesadowsky Bay, where the *Gauss* lay icebound during the winter. An ice free volcanic peak 1,200 feet high, which was discovered, was named the Gaussberg.

A telegram has been received, according to Reuter's Agency, from Major Powell Cotton, Northumberland Fusiliers, who left England about a year ago on an expedition across Africa from Mombasa, *viâ* Lake Rudolph and the Upper Nile. After leaving Mount Elgon, to the northeast of Victoria Nyanza, and remaining some time with the cave dwellers there, he marched due north, and since January has been traveling largely through unknown country. On May 11 he reached Obbo, some fifty miles to the northeast of Dufile. On January 1 the explorer left Mount Debasien, and proceeded through Karamojo to Tarash, in Western Turkana, in the Rudolph Province. In this region the tribes did not prove to be unfriendly, and, contrary to expectation, the notorious Turkana gave no trouble to the expedition. The country, however, was difficult and waterless. North of Tarash Major Powell Cotton crossed Captain Wellby's route and proceeded through Southern Dabossa and Dodinga to the Nile Province. During this portion of the route, part of which was unexplored, the natives were hostile. The explorer was in good health, and has secured some splendid trophies. He will probably be next heard of at Khartum.

English journals announce that an expedition is to start for New Guinea in August for the purpose partly of ethnological investigation, but also with the object of collecting data in regard to the distribution and etiology of cancer. The latter portion of the work has been officially recognized by the Cancer Commission. A grant has been made by the Royal Society towards the expenses of the expedition, and the Royal Geographical Society has undertaken to lend the greater part of the instruments for the geographical investigations which are to be carried out. The expedition, which has been organized in London by Major W. Cooke Daniels, will be unusually well equipped, and a schooner with auxiliary steam power will serve as a movable base. There

will also be a sea-going launch. Major Daniels, who has had much tropical experience, will devote himself mainly to ethnology and experimental psychology. Dr. C. G. Seligmann, until recently the superintendent of the clinical laboratory, St. Thomas's Hospital, is the representative of the Cancer Commission on the expedition, of which he is in general medical charge. With Dr. W. Mersh Strong, he will pay attention to pathological questions of a more general character. Dr. Strong will be responsible for the geographical and geological observations. The photographic work, which will include the use of the latest form of cinematograph for recording native dances and ceremonies, will be undertaken by Mr. A. H. Dunning.

REUTER'S agency is informed that Commander Irizar, the Argentine naval officer who will command the relief expedition which is being sent out by the Argentine government in search of Dr. Otto Nordenskjöld's south polar expedition, will leave for Buenos Ayres in a few weeks. The relief vessel—the *Uruguay*—is an Argentine gunboat sheathed with wood, and has been selected as being specially adapted for the work in hand. She will be strengthened so as to withstand ice pressure. The complete plans of the relief expedition are not yet fully known. The ship will be in charge of Argentine officers and crew, and will be provisioned for two years. It is not, however, probable that she will winter in the Antarctic. Commander Irizar is leaving for Norway in a few days to buy furs and other stores. He was formerly in command of the Argentine warship *Patria*, in which ship Sub-Lieutenant Soveral, the Argentine officer now with Dr. Nordenskjöld, was serving.

THE London *Times* states that the Museum of Zoology, of Cambridge University, has recently received a collection of books and specimens, bequeathed by the late T. E. Buckley, B.A., of Trinity College. In 1873 Mr. Buckley was given a grant from the Worts Fund, as the result of which he visited South Africa, returning with a valuable series of mammalian skeletons, which are now in the museum. In later years he continued to take a special interest in the same part of the world, and he accumulated a considerable collection of books and memoirs relating to African exploration, and in particular of those concerned with zoology. These books have now been bequeathed to the museum, and they constitute a most valuable and interesting collection of some 440 volumes, besides various unbound pamphlets. The remainder of Mr. Buckley's bequest consists of a collection of nearly 400 birds and numerous birds' eggs. These have not yet been thoroughly examined, but they appear to be in admirable condition, and they form a valuable addition to the museum.

UNIVERSITY AND EDUCATIONAL NEWS.

ILLINOIS COLLEGE, Jacksonville, receives nearly the entire estate, valued at $75,000, of the late Dr. Hiram K. Jones.

THE late Mrs. Harriet Lane Johnston, of Washington, has bequeathed $60,000 to the Johns Hopkins University for the establishment of three scholarships. She has also bequeathed $300,000 for the establishment of an episcopal school at Washington for the maintenance, education and training of choir boys.

MRS. JANE L. STANFORD, having now delegated to the board of trustees of Leland Stanford Junior University the powers she formerly retained, has been elected president of the board.

THE department of physics and electrical engineering at Lehigh University has been reorganized with Professor Wm. S. Franklin in charge of physics and Professor Wm. Esty in charge of electrical engineering. Professor Franklin is a graduate of the University of Kansas. He has pursued graduate study in physics at the University of Kansas, at the University of Berlin, at Harvard University and at Cornell University. He was five years in charge of physics and electrical engineering at Iowa State College and he has been for six years in charge of physics and electrical engineering at Lehigh University. Professor Esty is a graduate of Amherst College and of the Massachusetts Institute of Technology.

He was for one year with the General Electric Company at Lynn, Mass., eight years at the University of Illinois as instructor and as assistant professor of electrical engineering, and he has been for two years assistant professor of electrical engineering at Lehigh University.

The University of St. Louis, which recently purchased the Marion-Sims-Beaumont College of Medicine, has appointed Dr. Albert C. Eycleshymer, assistant professor of anatomy in the University of Chicago, as director of its Anatomical Department.

Benjamin S. Marigold, A.B. (Harvard, '76), Ph.D. (1901), instructor in industrial chemistry at the Worcester Polytechnic Institute for the past three years, has been appointed assistant professor of chemistry in Clark College. In the same institution Mr. James P. Porter, A.M. (Indiana), for the past two years instructor in Indiana University, has been appointed instructor in psychology.

Dr. Henry Albert has been elected assistant professor of pathology and bacteriology in the College of Medicine in the University of Iowa.

Professor Hettner succeeded Professor Kammerer as rector of the Technological Institute at Charlottenburg on June 30. The number of students in the institute last winter was 4,460.

Mr. Alexander Darroch, M.A., has been appointed professor of education in the University of Edinburgh, in succession to Professor S. S. Laurie.

Mr. John McCrae, Ph.D., senior lecturer in chemistry at the East London Technical College, has been appointed lecturer in chemistry at Queen Margaret College, Glasgow University.

Mr. T. Loveday, assistant lecturer in English and philosophy at University College, Bangor, has been appointed professor of philosophy at University College, Cape Town.

The London *Times* states that a number of appointments have been made in the department of education at Owens College, Manchester, in addition to that of Mr. J. J. Findlay, Wadham College, Oxford, to the Sarah Fielden chair of education in succession to the late Professor Withers as already announced. A special professorship of the history and administration of education has been established by the council. This chair has been offered to and accepted by Mr. Michael E. Sadler, M.A., formerly a student of Christ Church, Oxford, and late director of special inquiries and reports under the Board of Education. Mr. Sadler will reside in Manchester for one term in each academic year, and during his residence will take an active part in the work of the department. Miss C. I. Dodd, mistress of method, has been appointed an additional lecturer in education. Mr. H. T. Mark, B.A. (London), B.Sc. (Victoria), has been appointed lecturer on school hygiene. Miss S. A. Burstall, B.A. (London), Girton College, Cambridge, headmistress of the Manchester High School for Girls, and Mr. J. L. Paton, M.A., late fellow of St. John's College, Cambridge, head master of the Manchester Grammar School, have accepted the posts of special lecturers in education, and will give occasional lectures on special subjects. A revised prospectus will be issued shortly containing a statement of the courses proposed to be offered during next session for students training to be primary or secondary teachers, as well as for acting teachers already engaged in teaching in primary and secondary schools. The following public lectures (free) have already been arranged: Monday, October 12, at 8 p.m., inaugural lecture by Professor Findlay on 'Training for the Teaching Profession.' A series of four lectures by Professor Sadler —(1) 'The Educational Problem in England'; (2) 'The Task of the Local Education Authorities' (Wharburton lecture); (3) 'The Universities and National Education'; (4) 'The Need for Scientific Investigation in Education.'

Dr. H. Spencer Harrison has been appointed demonstrator and assistant lecturer in biology at University College, Cardiff.

Dr. T. Slater Price succeeds Mr. Woodward as director of chemical studies at Birmingham Municipal Technical School.